

CHAPTER 1

INTRODUCTION

This report is the ninth in a series of Congressionally mandated biennial reports on the status of women and minorities in science and engineering. The primary purpose of this report is to serve as an information source on the participation of women, minorities, and persons with disabilities in science and engineering. It offers no endorsement or recommendations on policies or programs. The report documents both short- and long-term trends in the participation of women, minorities, and persons with disabilities in science and engineering education and employment.

Current data and historical trends from a number of National Science Foundation (NSF) surveys are reported, and also, where appropriate, findings from externally conducted research are cited. The report follows the chronological sequence of the educational system, then analyzes workforce participation.

Major Findings

Several major findings arise from an examination of data in this report.

- First, family income and education are related to the educational preparation and achievement of women and minority precollege students. For example, parental income is related to average scores on achievement tests. The higher proportion, in recent years, of women SAT test takers from lower income families could influence the average scores of women which tend to be lower on average than men's. Similarly, the higher proportion of minority achievement test takers from lower income families is related to lower average scores on these tests.
- Second, the number (and proportion) of women and minorities enrolling in and earning degrees in science and engineering is continuing to increase, whereas the number of white men doing so is decreasing.
- Third, access and accommodation continue

to be crucial to participation of persons with disabilities in science and engineering. Although employed scientists and engineers with disabilities differ little from those without disabilities in field of employment, employment sector, primary work activity, and salary, persons with disabilities are underrepresented among those with degrees in science and engineering. Also, among those with degrees in science and engineering, they are underrepresented among persons employed in science and engineering.

Representation in Science and Engineering

Substantial gains have been made in the participation of women, minorities, and persons with disabilities in science and engineering in the last two decades. The gender gap in high school mathematics course taking has disappeared for the most part, and women are earning close to half of the bachelor's degrees in science and engineering. The employment experiences of women, minorities, and persons with disabilities in science and engineering are also improving. Unemployment rates no longer differ by sex, although differences remain among racial/ethnic groups and between those with and without disabilities. Salaries, controlling for field and length of experience, are similar across sex, race/ethnicity, and disability categories and the proportions of scientists and engineers in management within certain age categories are similar across sex, racial/ethnic, and disability categories. Despite similarities, widely different levels of participation exist within fields, degree levels, and sectors of employment.

Women

Women are approaching half of science and engineering bachelor's degree recipients. The proportion

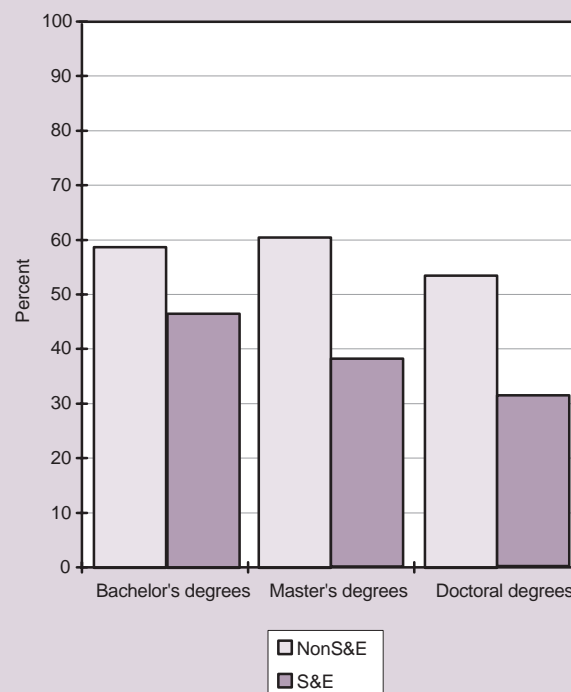
of bachelor's degrees in science and engineering awarded to women held fairly constant in the early to mid-1980s at 38 to 39 percent but has been steadily increasing since then, reaching 46 percent in 1995. (See appendix table 3-3.) Women have been more than half of bachelor's degree recipients in non-science-and-engineering fields since at least 1966 and were 59 percent of bachelor's degree recipients in non-science-and-engineering fields in 1995. Within science and engineering, some fields have a higher proportion of women than others. In 1995, women earned 73 percent of bachelor's degrees in psychology, 50 percent of bachelor's degrees in biological/agricultural sciences, and 50 percent of bachelor's degrees in social sciences. They earned about one-third of the bachelor's degrees in physical sciences; earth, atmospheric and ocean sciences; and in mathematical/computer sciences. They earned 17 percent of the bachelor's degrees in engineering.

Women earn a smaller proportion of master's and doctoral degrees in science and engineering than they do of bachelor's degrees. In 1995, women were 38 percent of master's degree recipients and 31 percent of doctorate recipients in science and engineering. (See appendix table 4-27.) By contrast, in non-science-and-engineering fields, women earn about the same proportion of advanced degrees as they do of bachelor's degrees. In 1995, women earned 59 percent of bachelor's degrees, 60 percent of master's degrees, and 53 percent of doctoral degrees in non-science-and-engineering fields. (See figure 1-1 and appendix table 4-28.)

Women constitute 46 percent of the U.S. labor force, and 22 percent of scientists and engineers in the labor force. (See appendix table 1-2 and text table 1-1.) The lesser representation in science and engineering compared to the labor force as a whole can be explained in part by their more recent entry into science and engineering and by the higher proportion of women than men with science and engineering degrees who are employed outside of science and engineering. The highest degree earned and the science and engineering field in which women earn their degrees influence participation in the science and engineering labor force. For example, a large proportion of women who earned bachelor's degrees in the social sciences, which are defined by NSF as science and engineering degrees, are then employed in social services occupations (for example, social worker, clinical psychologist).¹

¹ Social services occupations are defined in NSF surveys as non-science-and-engineering occupations.

Figure 1-1.
Percentage of degrees in science and engineering and in non-science-and-engineering fields to women, by level of degree: 1995



See appendix tables 4-27 and 4-28.

Women, Minorities, and Persons With Disabilities in Science and Engineering: 1998

Minorities²

Blacks, Hispanics, and American Indians are less likely than whites to participate in higher education whether in science and engineering or in non-science-and-engineering fields. Although blacks, Hispanics, and American Indians as a group are 23 percent of the U.S. population, they are 21 percent of college enrollment, 14 percent of non-science-and-engineering bachelor's degree recipients and 13 percent of science and engineering bachelor's degree recipients. (See text table 1-1 and appendix tables 1-1, 3-1, and 3-7.)

College enrollment and degree attainment by blacks, Hispanics and American Indians has been increasing. Minority enrollment has been steadily increasing since

² The term "minority" includes all groups other than white; "underrepresented minorities" includes three groups whose representation in science and engineering is less than their representation in the population: blacks, Hispanics, and American Indians. In accordance with Office of Management and Budget guidelines, the racial/ethnic groups described in this report will be identified as white, non-Hispanic; black, non-Hispanic; Hispanic; Asian or Pacific Islander; and American Indian or Alaskan native. In text and figure references, these groups will be referred to as white, black, Hispanic, Asian, and American Indian. In instances where data collection permits, subgroups of the Hispanic population will be identified by subgroup name.

Text table 1-1.

Selected indicators of participation in science and engineering, by sex, race/ethnicity, and disability status; 1995

Dash indicates not available.

Sex and race/ethnicity	Resident population of U.S. ¹	BA/BS degrees in nonS&E ²	BA/BS degrees in S&E ²	S&E graduate school enrollment ³	PhD degrees in S&E ⁴	U.S. labor force ⁵	S&E labor force ⁶
All races.....	100%	100%	100%	100%	100%	100%	100%
Men.....	48.9	40.4	53.5	58.6	63.7	54.1	77.6
Women.....	51.1	59.6	46.5	41.4	36.3	45.9	22.4
White, not Hispanic.....	73.5	79.5	76.6	75.9	73.2	84.6	83.8
Men.....	35.9	32.6	42.0	45.1	45.7	46.3	65.6
Women.....	37.6	46.9	34.6	30.8	27.5	38.3	18.2
Asian.....	3.4	4.0	7.6	8.0	19.3	—	9.7
Men.....	1.6	1.6	4.2	5.1	13.5	—	7.5
Women.....	1.7	2.4	3.4	2.9	5.8	—	2.2
Black, not Hispanic.....	12.0	7.7	7.1	5.6	2.9	11.2	3.4
Men.....	5.7	2.6	2.9	2.5	1.5	5.4	2.1
Women.....	6.3	5.0	4.3	3.1	1.4	5.8	1.3
Hispanic.....	10.4	5.9	5.8	4.3	3.0	9.2	2.8
Men.....	5.3	2.2	2.9	2.3	1.8	5.5	2.2
Women.....	5.1	3.7	2.9	2.1	1.2	3.6	0.7
American Indian.....	0.7	0.6	0.6	0.5	0.4	—	0.2
Men.....	0.4	0.2	0.3	0.2	0.2	—	0.2
Women.....	0.4	0.4	0.3	0.2	0.1	—	0.1
Persons with disabilities.....	20.6	—	—	—	1.3	13.9	4.9
Men.....	9.7	—	—	—	0.9	7.6	3.9
Women.....	10.9	—	—	—	0.4	6.4	1.0
Persons without disabilities.....	79.4	—	—	—	98.7	86.1	95.1
Men.....	39.2	—	—	—	67.9	46.5	73.7
Women.....	40.2	—	—	—	30.7	39.6	21.4

¹ Sources: U.S. Bureau of the Census, Population Division, Release PPL-57. *United States Population Estimates, by Age, Sex, Race, and Hispanic Origin, 1990 to 1996*. Data by disability status are from the Census' 1994 Survey of Income and Program Participation.

² Figures are for U.S. citizens and permanent residents only. Total includes persons with unknown race/ethnicity. Source: Tabulations by National Science Foundation/SRS; data from National Center for Education Statistics IPEDS Completions Survey, 1995.

³ Figures are for U.S. citizens and permanent residents only. Source: National Science Foundation, Survey of Graduate Students and Postdoctorates in Science and Engineering, 1995.

⁴ Figures by race and sex are for U.S. citizens and permanent residents only. Source: National Science Foundation, Survey of Earned Doctorates, 1995.

⁵ Source: U.S. Department of Commerce, Bureau of the Census, 1995, Current Population Reports. Details will not add to totals because data for "other races" group are not presented and Hispanics include both white and black population groups. Data by disability status are for persons age 15 to 64, are from the Census' 1994 Survey of Income and Program Participation and refer to employed persons rather than persons in the labor force.

⁶ Source: National Science Foundation, SESTAT data system, 1995. Data by disability status refer to employment rather than participation in the labor force.

NOTE: Because of rounding, details may not add to totals.

1990, both in numbers and as a percentage of total enrollment. In 1990, underrepresented minorities were 17 percent of all undergraduate students; by 1994, they were 21 percent. (See appendix table 3-7.) Minority women are a larger percentage of undergraduate students than are minority men. Underrepresented minority women constituted 12 percent of total undergraduate enrollment in 1994 whereas underrepresented minority men constituted 8 percent.

Both the number and proportion of degrees in science and engineering earned by minorities increased since 1990. By 1995, blacks earned 7 percent of science and engineering bachelor's degrees to U.S. citizens and permanent residents, up from 5 percent in 1985; Hispanics earned 6 percent, up from 4 percent; and American Indians earned 0.6 percent, up from 0.4 percent.³ (See appendix table 3-1.) A higher proportion of bachelor's degrees in science and engineering to blacks, Hispanics, and American Indians were earned in social science (38 percent) and in psychology (21 percent) than was the case for other groups: 34 percent of those earned by whites and 24 percent of those earned by Asians were in social science and 19 percent of those earned by whites and 11 percent of those earned by Asians were in psychology.

Underrepresented minorities as a whole are 6 percent of the science and engineering labor force. Asians are 10 percent of the science and engineering labor force. (See text table 1-1.)

Minority Women

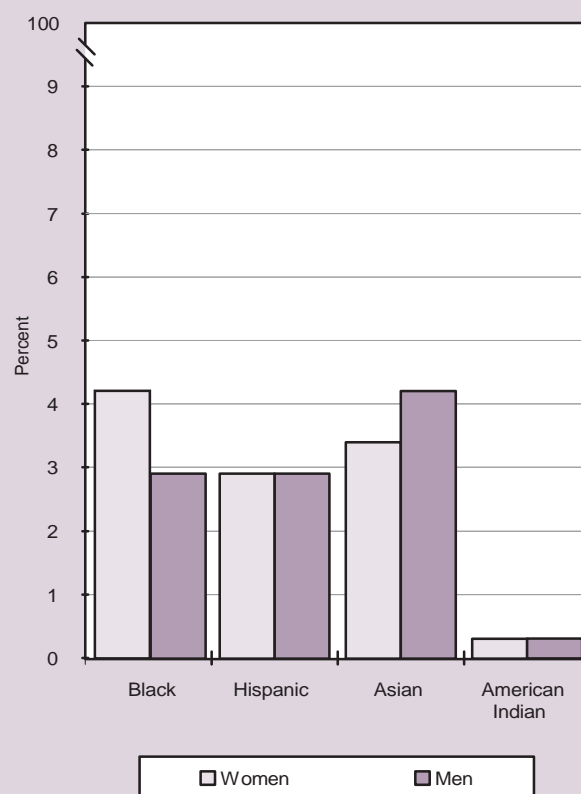
Minority women are as well represented among science and engineering bachelor's degree recipients as minority men, for the most part. Black women are more likely than black men to earn bachelor's degrees, whether in science and engineering or in other fields. Black women were 4.3 percent of science and engineering and 5.0 percent of non-science-and-engineering bachelor's degree recipients in 1995; black men were 2.9 percent and 2.6 percent, respectively. (See figure 1-2.) The same proportion of bachelor's degrees in science and engineering were earned by Hispanic women and Hispanic men (2.9 percent) in 1995. Likewise, the same proportion of American Indian women and American Indian men (0.3 percent) earned bachelor's degrees in science and engineering in 1995. Asian women were a slightly smaller proportion (3.4 percent) of bachelor's degree recipients in science and engineering than were Asian men (4.2 percent).

As is the case for minority men, black, Hispanic, and American Indian women are less represented among bachelor's degree recipients, whether science and engineering, or non-science-and-engineering, than they are among the population as a whole. As a group,

they were 12 percent of the population, 9 percent of non-science-and-engineering bachelor's degree recipients, and 7 percent of science and engineering bachelor's degree recipients in 1995. Asian women, however, were 2.4 percent of non-science-and-engineering and 3.4 percent of science and engineering bachelor's degree recipients and were 1.7 percent of the population. (See text table 1-1.)

Black, Hispanic, and American Indian women are less represented among science and engineering doctoral degree recipients than are minority men. As a group, they earned 2.8 percent of science and engineering doctorate degrees to U.S. citizens and permanent residents in 1995. (See appendix table 4-40.) Black, Hispanic, and American Indian men are 3.5 percent of science and engineering doctorate recipients. Asian women are a higher proportion of science and engineering doctorate recipients than they are of bachelor's degree recipients, but are less likely than Asian men to earn doctoral degrees in science and engineering.

Figure 1-2.
Percentage of bachelor's degrees in science and engineering and in non-science-and-engineering fields to men and women, by race/ethnicity: 1995



See appendix tables 3-17, 3-18, and 3-19.

Women, Minorities, and Persons With Disabilities in Science and Engineering: 1998

³ U.S. citizens and permanent residents only.

Minority women (including Asians) are 19 percent of all women in the science and engineering labor force and 4 percent of all scientists and engineers in the labor force. (See text table 1-1 and appendix table 5-22.) Within every racial/ethnic group, women are a smaller proportion of the science and engineering labor force than are men. (See figure 1-3.) Field of degree results in differences in employment statistics, as will be discussed in chapter 5.

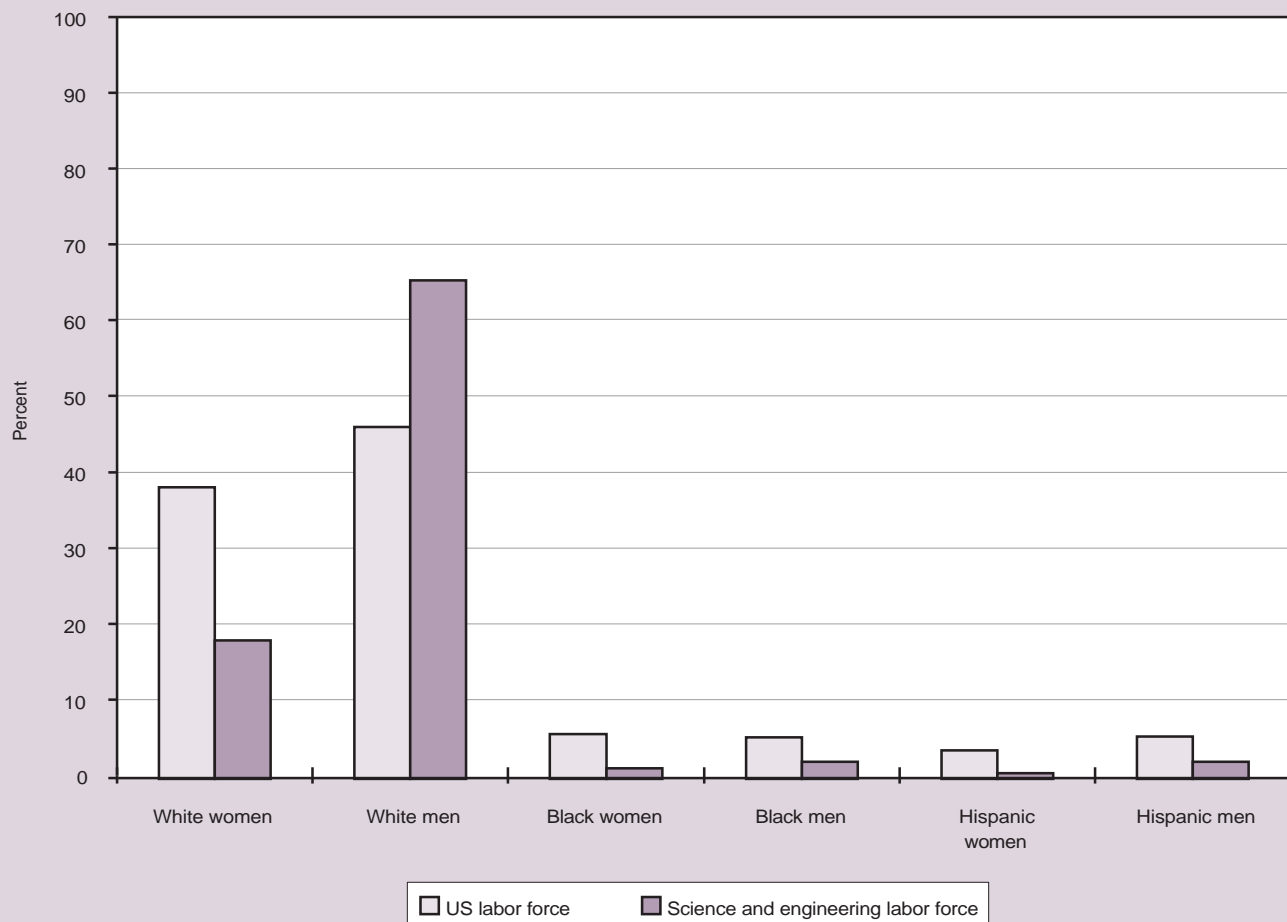
Field choices of minority women are more similar to those of white women than to those of minority men. Smaller proportions of black and Hispanic women than of black and Hispanic men are in engineering, and higher proportions are in the broad fields of computer/mathematical sciences and social sciences. Asian women are more likely than other women to be engineers and less likely than other women to be social scientists. (See appendix table 5-22.)

Persons With Disabilities

Data on participation of persons with disabilities are less available than data on other groups. These data are seriously limited for several reasons. First, there have been differing operational definitions of “disability” that include a wide range of physical and mental conditions. Different sets of data have used different definitions and thus are not totally comparable. Second, data about disabilities are frequently not included in comprehensive institutional records (for example, in registrars’ records in institutions of higher education). Concerns about confidentiality often inhibit collection or dissemination by institutions of data on disabilities. The third limitation on information on persons with disabilities gathered from surveys is that it often is obtained from self-reported responses. Typically, respondents are asked if they have a disability and to specify what kind of disability it is. Resulting

Figure 1-3.

Percentage of the U.S. civilian labor force and the science and engineering labor force, by sex and race/ethnicity: 1995



See appendix tables 1-2 and 5-22.

data, therefore, reflect individual decisions to self-identify, not objective measures.

Although NSF collects data on persons with disabilities in most of its surveys and uses common definitions among its surveys, these surveys cover people who earn doctoral degrees in science and engineering or who are employed in science and engineering. NSF does not collect data on precollege education or undergraduate education. The National Center for Education Statistics of the Department of Education does collect data on those levels of education, but in most instances does not include measures of disability status. For example, colleges and universities do not maintain data on students with disabilities. Therefore, enrollment and degree data collected from colleges and universities are not reported by disability status.

Estimates of the proportion of the population with disabilities vary greatly. About 20 percent of the population have some form of disability, with about 10 per-

cent of the population having a severe disability.⁴ (See appendix table 1-3.) These disabilities may or may not require accommodation or limit an individual's ability to participate in educational experiences or to be productive in an occupation; these factors account for some of the variability in estimates of the size of this population.⁵

Persons with disabilities are underrepresented in the workforce and in the science and engineering workforce. Persons with disabilities were 13.9 percent of employed persons in 1994 and 4.9 percent of employed scientists and engineers in 1995.⁶ (See text table

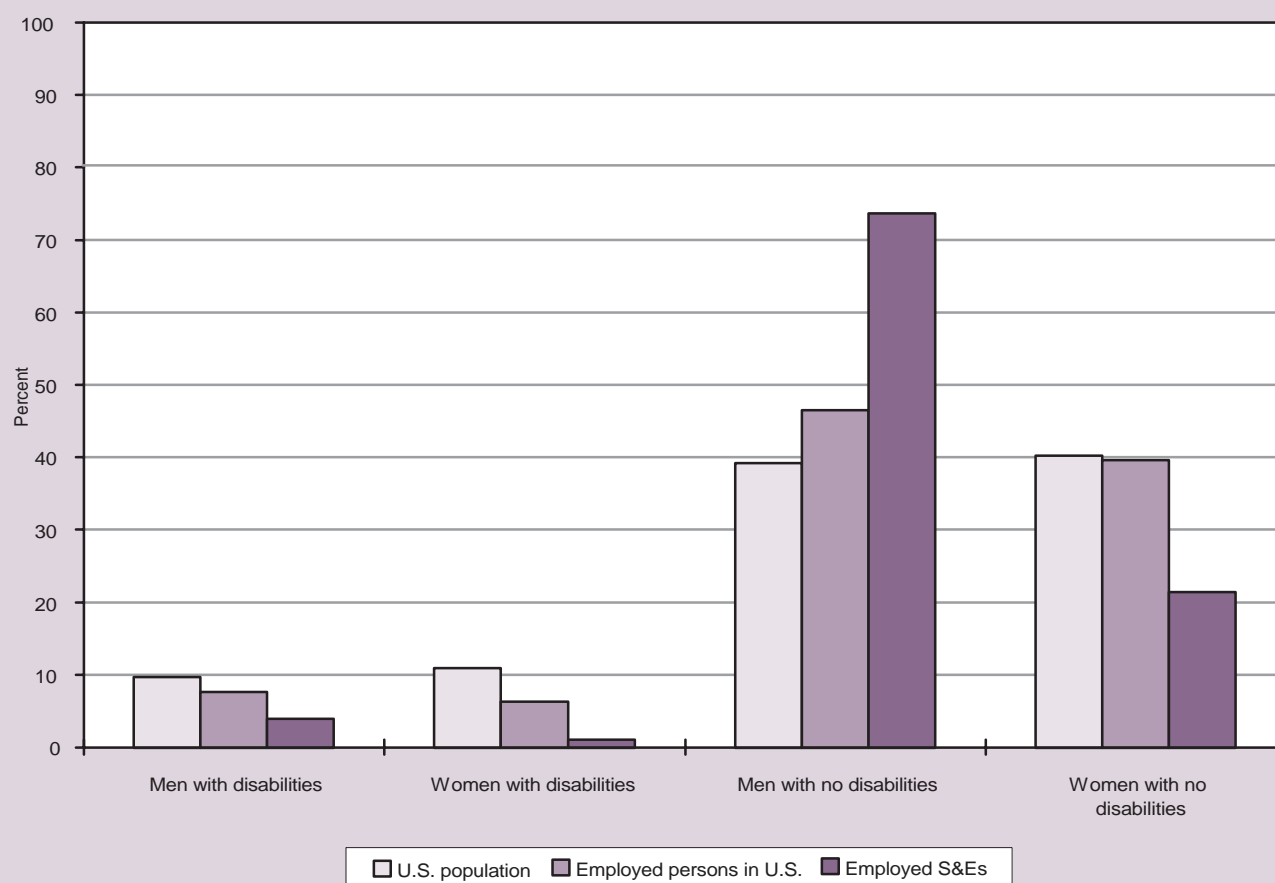
⁴ Estimates of the proportion of the population with disabilities vary due to differing definitions of "disability." See the technical notes in appendix A for a discussion of the limitations of estimates of the size of this group.

⁵ For a discussion of the data problems in describing the population with disabilities, see McNeil (1993).

⁶ The incidence of disability increases with age. More than half of doctoral scientists and engineers who indicate they have a disability became disabled at age 30 or later. See appendix table 5-29.

Figure 1-4.

Percentage of the U.S. population, employed persons in United States, and employed scientists and engineers, by sex and disability status: 1995



See appendix table 1-3 and text table 1-1.

1-1 and appendix table 1-4.) Women with disabilities are less likely than men with disabilities to be employed and to be employed in science and engineering. (See figure 1-4 and appendix table 1-5.)

Data Sources

Data for this report come from a number of sources. (See appendix A, "Technical Notes.") The primary sources of information are surveys conducted by NSF's Division of Science Resources Studies. Other sources include surveys conducted by the Department of Education's National Center for Education Statistics (NCES).

Data on bachelor's and master's degrees come from the Integrated Postsecondary Education Data System's (IPEDS) Completions Survey, which is part of an integrated system of surveys conducted by the National Center for Education Statistics. This survey provides data on the number and types of degrees awarded by U.S. postsecondary institutions and data on the characteristics of degree recipients.

Graduate enrollment data come from NSF's Survey of Graduate Students and Postdoctorates in Science and Engineering. This survey provides data on the number and characteristics of graduate science and engineering students enrolled in U.S. institutions, differences in enrollment patterns, and differences in financial support patterns.

The Survey of Earned Doctorates is the source of data on doctoral degrees. This survey, which is conducted for the National Science Foundation, the National Institutes of Health, the National Endowment for the Humanities, the U.S. Department of Education, and the U.S. Department of Agriculture, annually provides data on the number and characteristics of individuals receiving research doctorate degrees⁷ from U.S. institutions.

Employment data come primarily from three surveys that form an integrated system of NSF surveys called the Scientist and Engineer Statistics Data System (SESTAT) to produce national estimates of the entire science and engineering workforce. The Survey of Doctorate Recipients provides demographic and employment information on individuals with doctoral degrees in science and engineering. This survey is a longitudinal survey of a sample of individuals under the age of 76 who received a research doctorate in science or engineering from a U.S. institution and who were living in the United States. The National Survey of Recent College Graduates provides employment and demographic data on individuals who recently

obtained bachelor's or master's degrees in science or engineering fields. The National Survey of College Graduates provides data on the number and characteristics of individuals with training and/or employment in science and engineering in the United States.

The "Technical Notes" found in appendix A present information on the underlying concepts, data collection techniques, reporting procedures, and statistical reliability of the primary data sources used in this report.

Statistical Reliability of Comparisons

The "Technical Notes" found in appendix A present information on the primary data sources used in this report. Many of the data sources used in this report are sample surveys. Information presented from sample surveys has differing degrees of reliability. Survey summaries may differ from the actual values for the population under study due to a number of sources contributing error to the estimates. This report states differences in comparisons of groups or in trends in the data over time only if they are greater than the differences that would be likely to result due to chance. (In statistical terms, for this report the impact of sampling error is accounted for by testing at the 95 percent confidence level any individual comparisons presented.) Where possible, analysts have also considered the impact of nonsampling errors such as incomplete coverage and nonresponse.

Organization of Report

Chapter 2 focuses on precollege mathematics and science education, including factors influencing science and mathematics achievement, course taking, test scores, and attitudes toward science and engineering.

Chapter 3 examines undergraduate education as preparation both for careers and for graduate education. This chapter presents data on trends in enrollments and degrees in 2- and 4-year colleges and universities and college course taking patterns.

Chapter 4 addresses graduate enrollment, degrees, and financial support. It presents data on trends in enrollments and degrees, primary source of support in graduate school, and time to completion of PhD.

Chapter 5 examines employment patterns including unemployment, full- and part-time employment, and employment by field and sector. It also focuses separately on academic and nonacademic employment.

References and Data Sources

McNeil, John M. 1993. *Americans With Disabilities, 1991-92: Data from the Survey of Income and Program Participation*. Bureau of the Census,

⁷ Research doctorates are doctorates which require original research. These include most PhD, and some Ed.D. and D.Sc. degrees. Nonresearch doctorates and first-professional degrees such as the J.D., M.D., D.D.S., or Psy.D. are not included in the Survey of Earned Doctorates.

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